ARRANGEMENT IN GRINDING MILLS

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ABSTRACT

A material discharging device for a drum-type continuous grinding mill having an end wall associated with outlet means for discharging from the mill grinding chamber a relatively finely ground material and a mixed material containing both relatively finely ground material and relatively coarse material. The mixed material outlet means comprises outlet openings connecting the chamber with duct means for carrying the mixed material discharged through said outlet openings to an axial discharge pipe. The discharge pipe is associated with a two-way valve, the one setting of which returns the arriving mixed material to the chamber and the other setting discharges the arriving mixed material from the mill shielded by said discharge pipe from the flow of relatively finely ground material leaving the mill.

7 Claims, 3 Drawing Figures
ARRANGEMENT IN GRINDING MILLS

The present invention relates to a device in a drum mill for continuous grinding and of the type including an essentially cylindrical casing and end walls at the ends of said casing, one end wall being associated with outlet means for discharging from the grinding chamber of said mill a relatively finely ground material and a mixed material containing both relatively finely ground material and relatively coarse pieces of material, at least the outlet means for the mixed material including a number of outlet openings connecting the grinding chamber with at least one duct for carrying the mixed material discharged from the grinding chamber towards the centre of said one end wall.

In grinding mills of the aforementioned type, which may comprise autogeneous or semi-autogeneous grinding mills but also grinding mills where the grinding action is mainly effected by foreign grinding bodies, such as grinding balls, it is often desired to obtain the discharged mixed material or the coarse material in the mixed material separated or substantially separated from the discharged fine material. The discharged coarse material, which can be composed of relatively large pieces of such material undergoing grinding in the mill or of foreign grinding bodies charged to the mill and having been worn down to such an extent that they no longer cause the desired grinding action in the mill, can be intended for use in one or more subsequent grinding units wherein said discharged fine material shall be further ground and/or other material than said fine material shall be ground.

In mills of the type in question a number of arrangements have been previously proposed for the region of the mill discharge trunnion to sort material discharged from the grinding chamber into different fractions and to take off the different fractions separately from each other from the mill. It has also been proposed to combine these arrangements with devices for returning excess coarse material to the grinding chamber and also the intermediate fractions accompanying said mixed material. An inconvenience with these known arrangements is that from the point of view of design they are very complicated, and that the sorting devices, such as sieves and the like rotating together with the mill, due to the structures utilized must work with large amounts of material causing heavy wear. By reason of the complicated construction, the practical field of use is reduced considerably, and furthermore inspection as well as the repair and exchange of worn parts is made more difficult in these known sorting and material conveying arrangements.

The object of the invention is to provide a new operationally reliable and cheap device of simple design which is particularly useful in practice for conducting material from mills of the type in question, said device not being burdened with the aforementioned inconveniences.

In pursuance of this object it is proposed according to the invention that in a device of the type defined in the introduction above, the said duct in the central region of said one end wall opens out into a discharge pipe which is associated with a two-way valve for conducting the mixed material arriving from the duct either back again to, or in a direction from the grinding chamber and which shields the outgoing flow of mixed material from the flow or relatively finely ground material discharged from the grinding chamber. The advantage is gained by this arrangement that the mixed material containing the more wearing coarse material is kept separate all the time from the discharged fine material, and that the excess of mixed material leaving the grinding chamber circulates in a closed system formed by the grinding chamber, said duct and the valve, without either infringing on the discharge of the fine material or loading subsequent parts of the discharged structure.

In the following the invention will be more closely described while referring to the attached drawing, further distinguishing features of the invention thereby becoming apparent.

FIG. 1 shows diagrammatically an axial sectional view of the discharge portion of a drum mill having a device according to the invention.

FIG. 2 is a sectional view taken through the line II—II in FIG. 1.

FIG. 3 shows diagrammatically an axial sectional view of the discharge trunnion of a drum mill incorporating an alternative embodiment of the device according to the invention.

Identical or substantially identical elements are identified in the different Figures by the same reference numerals.

In FIGS. 1 and 2, which show portions of the discharge end of an autogeneous grinding mill 10, the end wall and the cylindrical casing of the mill at the discharge end thereof are indicated by the numerals 11 and 12, respectively. The casing of the mill is internally lined with a rubber lining 13 and is provided with a number of lifting bars or lifters 14, which project above said lining and which in the same way chiefly consist of rubber. The end wall 11 is also provided with a lining 15 consisting of a number of sector-shaped plates from which project radially positioned webs 16 which carry flange portions 17 on their edges facing the interior of the mill, said flange portions carrying in turn an inner wall 18 consisting of sector-shaped rubber plates. The inner wall 18 is provided with a number of radially positioned lifters 19 and defines, together with the webs 16 and the lining 15, a plurality of sector-shaped spaces 20, 21 (FIG. 2). The inner wall 18 is provided with groups of openings 22, 23. The openings 22, which are comparatively small and of which only one group is shown in FIG. 1, connect a plurality of spaces 20 with the grinding chamber 24 of the mill 10 and serve to discharge comparatively fine material from the grinding chamber 24. The openings 23, which are comparatively large and of which only one group is shown in FIG. 1, connect a plurality of spaces 21 with the grinding chamber 24 and serve to discharge a mixed material containing both comparatively fine and comparatively coarse material from the grinding chamber. In practice the smallest cross dimension of the openings 23 necessarily about 5 to 10 times larger than the smallest cross dimension of the openings 22. When using the mill as a primary mill for grinding ore, which, for example, is to be enriched by flotation techniques, the openings 22 normally have a smallest cross dimension of the order of 8–16 mm, e.g. approximately 12 mm, whilst the openings 23 suitably may have a smallest cross dimension of between 70 and 100 mm, e.g. approximately 90 mm.

The spaces 21 receiving material via the openings 23 form ducts for conducting mixed material towards the centre region of end wall 11 and open out into a common discharge pipe 25 which is associated with a two-
3,924,814

way valve generally designated by 26 for conducting the mixed material arriving from the ducts 21 either back to or in a direction from the grinding chamber 24. The pipe 25 shields the outgoing flow of mixed material from the flow of fine material fed out from the grinding chamber, said fine material passing into the spaces 20 through the openings 22. The spaces 20 also form ducts for conducting the fine material towards the central region of the end wall 11 and open out in a pipe 28 forming a lining in the mill trunnion 27 and surrounding the discharge pipe 25 essentially coaxially therewith. The pipes 25 and 28 open out via separate discharge hoppers 30 and 29, respectively, into a stationary material receiving device 31 connected to the discharge end of the mill trunnion. Designated by the numeral 32 there is a portion of a support means, which via a bearing device 33 supports the mill trunnion 27.

The valve 26 includes a rod-like part 34 extending through a cylindrical valve housing 35, which via hopper-like portions 36 communicates with the spaces 21. Mounted on the part 34 are two valve discs or plates 37, 38, by means of which the one or the other of the end openings of the valve housing can be closed. The valve rod 34 is connected, via a power transmitting device in the form of an extension 39, to the piston rod of a valve setting device designed as a pressure cylinder 40 carried by the device 31 and situated outside the mill. The valve rod 34 is adjustable by means of a pressure cylinder 40 between the position shown by full lines in which the valve plate 38, by abutment against the end of the cylindrical valve housing 35 facing the grinding chamber 24 of mill 10, closes the spaces 21 against said grinding chamber, and a position shown by chain lines in which the valve plate 37 closes the axially outer opening of valve housing 35 and the valve plate 38 is located at a distance from the axially inner opening of the valve housing 35 so that the material which has come into the spaces 21 can pass back again into the grinding chamber of the mill 10. In the discharge pipe 25 are arranged radial supporting struts 41, supporting a pipe 42 in which the extension 39 is displacedably mounted. The discharge pipe 25 is supported in its turn by supporting struts 43 extending between the pipes 25 and 28. The portion of the extension 39 located between the valve plate 37 and the inner end of the pipe 42 is protected by means of a sealing bellows 44. Arranged between the outer end of the extension 39 and the piston rod of the cylinder 40 is a coupling 45 permitting rotation of the extension 39 relative to the piston rod.

In the second embodiment of the invention shown in FIG. 3, the two-way valve 26 is only provided with one valve plate 37, the latter being displaceable between the position shown by full lines in which mixed material can be fed out through the discharge pipe 25, and the position shown by chain lines in which mixed material arriving through the hopper-like portion 36 is returned to the grinding chamber 24. The discharge pipe 25 is also provided with sieve openings 46 by means of which the mixed material departing the pipe 25 is freed from water and undesired finely particulate impurities, which are conducted to the fine material departing through the pipe 28. In front of the sieve openings 46, seen in the direction of feed, there are arranged shielding means in the form of circumferentially ex-

tending collars which prevent the inflow of water and fine material into the pipe 25 from the pipe 28. Further, in the region of the sieve openings 46 adjacent the outlet end of the pipe 25 means 48 are arranged for slowing down the mixed material flow, the separation of water and fine material being enhanced thereby. These means 48 are shown to have the form of a spiral, which is so arranged on the inside of the pipe 25 that it feeds the material towards the discharge end of the pipe 25 although whilst causing certain slowing down and re-

stratification of the material.

The invention is not limited to the embodiments shown on the drawing and described above but can be modified in many ways within the scope of the following claims.

We claim:

1. A device in a drum mill for continuous grinding and of the type including an essentially cylindrical casing and end walls, at the ends of said casing, one end wall being associated with outlet means for discharging from the grinding chamber of said mill a relatively finely ground material and a mixed material containing both relatively finely ground material and relatively coarse pieces of material, at least the outlet means for the mixed material including a number of outlet openings connecting the grinding chamber with at least one duct for carrying the mixed material discharged from the grinding chamber towards the centre of said one end wall, wherein said duct in the central region of said one end wall opens out into a discharge pipe which is associated with a two-way valve for conducting the mixed material arriving from said duct either back again to, or in a direction from the grinding chamber and which shields the outgoing flow of mixed material from the flow of relatively finely ground material discharged from the grinding chamber.

2. A device according to claim 1, wherein the discharge pipe at least along a portion of its length extends essentially coaxially inside an outer pipe for discharging the relatively finely ground material from the mill, said pipes each opening out into its own material receiving device.

3. A device according to claim 1, wherein the discharge pipe for mixed material is provided with sieve openings to lead liquid and finely particulate material from the mixed material passing through said pipe.

4. A device according to claim 3, wherein said openings are arranged in a portion of the discharge pipe for mixed material surrounded by an outer discharge pipe.

5. A device according to claim 4, wherein the discharge pipe for mixed material is coordinated with shielding means to hinder the inflow of fine material and liquid from the outer discharge pipe into the discharge pipe for mixed material.

6. A device according to claim 3, wherein the discharge pipe for mixed material at least in the region of said sieve openings is provided with means for slowing down the flow of the mixed material.

7. A device according to claim 1, wherein the valve comprises an adjustable valve member which is connected, via a power transferring device extending coaxially with and through the discharge pipe for mixed material, to a valve setting device located outside said discharge pipe.

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